Claims

1. *(Currently amended)* A head for thermally-assisted recording in tracks of a perpendicular magnetic recording layer comprising:

a head carrier having a recording-layer-facing surface and a trailing surface;

a write pole on the trailing surface for directing magnetic flux generally perpendicular to the recording layer, the write pole having a pole tip substantially at the recording-layer-facing surface, the write pole tip having a width substantially corresponding to the track width;

a shield of ferromagnetic material on the trailing surface and having ends substantially at the recording-layer-facing surface and spaced from the write pole tip, the shield substantially surrounding the write pole tip and substantially confining the magnetic flux from the write pole tip to the track width, the shield including side shields located on opposite sides of the write pole tip and a trailing shield; and

a resistive heater layer of electrically conducting material on the trailing surface for heating the recording layer in the presence of magnetic flux from the write pole, the heater layer having an edge substantially at the recording-layer-facing surface and wider than the write pole tip width; whereby regions of the recording layer wider than the track are heated, but thermally-assisted magnetic recording occurs only in the track.

2. *(Canceled)*

3. *(Canceled)*

4. *(Currently amended)* The head of claim 1 wherein the ~~shield includes side shieldslocated on opposite sides of the write pole, each side shield having an end spaced from a side of the write pole tip, and a~~ trailing shield is connected to the side shields ~~and having an end spaced from the write pole tip~~.

5. *(Currently amended)* The head of claim ~~3~~ 1 wherein the write pole tip is located between the heater layer edge and the trailing shield ~~end~~.

6. *(Original)* The head of claim 1 further comprising a return pole on the trailing surface and having an end substantially at the recording-layer-facing surface, the return pole being magnetically coupled to the write pole for providing a return path for magnetic flux from the recording layer.

7. *(Original)* The head of claim 6 wherein the shield is connected to the return pole, whereby magnetic flux from the recording layer is directed from the shield to the return pole.

8. *(Original)* The head of claim 6 wherein the heater layer edge is located between the write pole tip and the return pole end.

9. *(Original)* The head of claim 6 further comprising an electrically conductive coil between the write pole and the return pole for generating magnetic flux in the write pole when electrical current is passed through the coil.

10. *(Original)* The head of claim 1 wherein the head carrier is an air-bearing slider having an air-bearing surface as the recording-layer-facing surface.

11. *(Original)* The head of claim 1 further comprising a magnetoresistive read sensor on the trailing surface.

12. *(Currently amended)* A thermally-assisted perpendicular magnetic recording head for recording data in tracks of a disk having a perpendicular magnetic recording layer, the head comprising:

an air-bearing slider having an air-bearing surface as the recording-layer-facing surface and a trailing surface;

a write pole on the trailing surface for directing magnetic flux generally perpendicular to the recording layer, the write pole having a pole tip substantially at the recording-layer-facing surface, the write pole tip having a width substantially corresponding to the track width;

a shield of ferromagnetic material on the trailing surface and having ends substantially at the recording-layer-facing surface, the shield substantially surrounding the write pole tip and substantially confining the magnetic flux from the write pole tip to the track width, the shield including a trailing shield spaced down-track from the write pole tip and side shields located on opposite sides of the write pole tip and spaced cross-track from the write pole tip;

a return pole on the trailing surface and having an end substantially at the recording-layer-facing surface, the return pole being magnetically coupled to the write pole for providing a return path for magnetic flux from the recording layer; and

a resistive heater layer of electrically conducting material on the trailing surface between the write pole tip and the return pole for heating the recording layer in the presence of magnetic flux from the write pole, the heater layer having an edge substantially at the recording-layer-facing surface and wider than the write pole tip width; whereby regions of the recording layer wider than the track are heated, but thermally-assisted magnetic recording occurs only in the track.

13. *(Canceled)*

14. *(Canceled)*

15. *(Currently amended)* The head of claim 12 wherein the ~~shield includes side shields located on opposite sides of the write pole, each side shield having an end spaced from a side of the write pole tip, and a~~ trailing shield is connected to the side shields ~~and having an end spaced from the write pole tip~~.

16. *(Original)* The head of claim 12 wherein the shield is connected to the return pole, whereby magnetic flux from the recording layer is directed from the shield to the return pole.

17. *(Original)* The head of claim 12 further comprising an electrically conductive coil between the write pole and the return pole for generating magnetic flux in the write pole when electrical current is passed through the coil.

18. *(Original)* The head of claim 12 further comprising a magnetoresistive read sensor on the trailing surface.

19. *(Currently amended)* A thermally-assisted perpendicular magnetic recording disk drive comprising:

a perpendicular magnetic recording disk comprising a substrate, a magnetically-permeable underlayer on the substrate, and a magnetic recording layer on the underlayer, the recording layer storing recorded data in tracks and having perpendicular magnetic anisotropy;

an air-bearing slider maintained near the surface of the disk and having an air-bearing surface as the recording-layer-facing surface and a trailing surface;

a write pole on the slider trailing surface for directing magnetic flux generally perpendicular to the recording layer, the write pole having a pole tip substantially at the slider recording-layer-facing surface, the write pole tip having a width substantially defining the width of a data track when the disk is moved relative to the slider;

a shield of ferromagnetic material on the trailing surface and having ends substantially at the recording-layer-facing surface, the shield substantially surrounding the write pole tip and substantially confining the magnetic flux from the write pole tip to the data track width, the shield including a trailing shield spaced down-track from the write pole tip and side shields located on opposite sides of the write pole tip and spaced cross-track from the write pole tip;

a return pole on the trailing surface and having an end substantially at the recording-layer-facing surface, the return pole being magnetically coupled to the write pole for providing a return path for magnetic flux from the write pole tip through the recording layer and underlayer;

an electrically conductive coil between the write pole and the return pole for generating magnetic flux in the write pole when electrical current is passed through the coil;

a resistive heater layer of electrically conducting material on the trailing surface between the write pole tip and the return pole for heating the recording layer in the presence of magnetic flux from the write pole, the heater layer having an edge substantially at the recording-layer-facing surface and wider than the write pole tip width, whereby regions of the recording layer wider than the data track are heated but thermally-assisted magnetic recording occurs only in the data track; and

a magnetoresistive read head on the slider trailing surface for reading data recorded in the data tracks.

20. *(Canceled)*

21. *(Canceled)*

22. *(Currently amended)* The disk drive of claim 19 wherein the ~~shield includes side shields located on opposite sides of the write pole, each side shield having an end spaced from a side of the write pole tip, and a~~ trailing shield is connected to the side shields ~~and having an end spaced from the write pole tip~~.

23. *(Original)* The disk drive of claim 19 wherein the shield is connected to the return pole, whereby magnetic flux from the recording layer is directed from the shield to the return pole.

24. *(Original)* The disk drive of claim 19 wherein the magnetoresistive read head is located between the slider trailing surface and the write pole, the direction perpendicular to the trailing surface from read head to the write pole being the down-track direction.